Functional Solution Analysis Handbook

A Guide for Implementing Functional Solution Analyses

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Air Force FSA Implementation Guide

(A Guide for Performing Functional Solution Analysis):

About OAS

The Office of Aerospace Studies (OAS) provides technical, analytical, and costing support to the operational commands, Air Force Materiel Command (AFMC) and the Air Staff in planning, conducting, and reviewing Functional Solution Analyses (FSAs), Analysis of Alternatives (AoAs), and related studies supporting acquisition decisions. In addition, we support the MAJCOMs and AFMC product centers with analytical investigations and evaluations of systems and related issues. For additional information, visit our web site at (http://www.oas.kirtland.af.mil).

Preface

The FSA Implementation Guide is produced by the Air Force Materiel Command's Office of Aerospace Studies (OAS). OAS is designated the Air Force Center of Expertise for FSAs and AoAs. This handbook embodies Air Force's current guidance for planning and executing Air Force and Air Force-led FSAs within the Department of Defense (DoD) acquisition process.

This handbook is revised frequently to reflect any major evolution in the frequently changing acquisition, and capabilities/requirements processes. As changes occur, the individual chapters are updated to reflect the latest analysis techniques required to support acquisition efforts. We'd like to hear what you think about the Guide, especially if you have suggestions for improvements in organization, accuracy and/or content.

Introduction

The purpose of this guide is to provide instructions on how to implement the Functional Solution Analysis (FSA) requirements identified within CJCSI 3170.01C, AFI 10-601 and draft AFI 10-604. Specifically, this guide provides instructions for accomplishing the FSA required by the Joint Capabilities Integration and Development System (JCIDS) and the FSA review and documentation (for both FSA planning and execution) required by the AFROCC in support of Initial Capabilities Document (ICD) development. The JCIDS process is closely integrated with the acquisition process and exists to identify, develop, and validate defense-related requirements. This process validates warfighting capabilities or DoD business process capabilities while considering the full range of non-materiel and materiel solutions. The purpose of AFI 10-601 is to facilitate rapid development and fielding of affordable and sustainable operational capabilities needed by combatant commanders and those organizations employing business processes. This instruction serves as an instrument of the AFROCC who reviews, validates, and recommends approval of all Air Force (AF) capabilities based requirements and AF architectures. The FSA documentation required by the AFROCC includes assessments of the study plan and results of planned/completed FSAs for potential ACAT I efforts, supported by the Office of Aerospace Studies (OAS). The documented results of the FSA support the development of the ICD and provide a "jump start" for future analyses such as Analysis of Alternatives (AoAs). Draft AFI 10-604 implements effects based, capabilities based planning which is referred to as Capabilities Based Planning (CBP); it describes the process, results and products of the CBP approach.

The Functional Solution Analysis (FSA) is the third step of the JCIDS analysis process and is performed by the user/sponsor. It is preceded by two critical analyses known as the Functional Area Analysis (FAA) and the Functional Needs Analysis (FNA) that are the responsibility of the sponsor, combatant command (COCOM), or Functional Capabilities Board (FCB) according to CJCSM 3170.01. An FAA identifies the operational tasks, conditions, and standards needed to achieve military objectives while an FNA assesses the ability of the current and programmed joint capabilities to accomplish the tasks that the FAA identified under the full range of operating conditions and designated standards. The AF has implemented the Capabilities Review and Risk Assessment (CRRA) process to look at AF capabilities and needs. The development of the Concepts of Operations (CONOPS) during the CRRA process allows the AF to identify the operational tasks, conditions and standards needed to achieve military objectives that equate to the FAA results. Additionally, the CRRA will identify gaps or shortfalls in operational capabilities and the time frame such capabilities are needed which is similar to the FNA process. The user/sponsor lead for an identified need then conducts and documents a more rigorous FAA and FNA to broaden the understanding of the needed capability. The FAA and FNA are the first two steps of the JCIDS process.

The FSA, the third step of the JCIDS process, is an operationally based assessment of potential doctrine, organization, training, leadership & education, personnel, and facilities (DOTLPF) or materiel (M) approaches to solving (or mitigating) one or more of the capability gaps (needs) identified in the FNA. The needs identified in the FNA are inputs to the FSA; its outputs are potential solutions to needs including, in order of priority, DOTLPF changes; product improvements to existing materiel or facilities; adoption of interagency or foreign materiel

solutions; and finally, new materiel starts. The FSA is composed of three levels of analysis: (1) DOTMLPF Analysis, (2) Ideas for Materiel Approaches (IMAs) and (3) Analysis of Materiel Approaches (AMAs). See section 2 for more details for conducting an FSA.

Section 1 of this guide provides an overview of the JCIDS analyses processes; a step-by-step flow diagram of the FAA/FNA/FSA elements that must be accomplished during the JCIDS analyses process (See Figure 2-1); and details on the pre-FSA processes (FAA and FNA). The focus of this guide is on the FSA process; the FAA and FNA efforts should be accomplished by the user/sponsor (via the CRRA process) prior to initiating the FSA. Section 2 provides a detailed discussion of the FSA process including step-by-step details of what must be accomplished during the FSA. Section 3 provides recommended FSA Study Plan and "Results" document outlines. These FSA support documents are required by the AFROCC for both pre and post FSA reviews. The specifics of what must be accomplished during the FSA are outlined in these documents. Section 4 provides a notional assessment of the AFROCC FSA Study Plan assessment while section 5 provides a notional assessment of the AFROCC FSA "Results" document. These are the required assessment items for both the FSA Study Plan and "Results" document that will be presented to the AFROCC.

The type of capability and size of a potential acquisition program, or its applicability across the AF, DoD or other Federal Agencies, determines the level of effort (LoE) appropriate for determining the most cost-effective solution for providing a capability. The level of senior leadership interest and/or Congressional interest may also determine the rigor, and thus level of effort required to produce credible study results. The OAS and AF/XORD can aid in determining the appropriate level of effort required for individual studies. Appendix A includes a set of checklists for determining requirements and guidelines for the appropriate level of effort for a particular study.

The LoE for a study encompasses the number and/or type of personnel resources or participants, the time required to complete pieces of the study or the time restrictions placed on the study by leadership, the amount of *qualitative* (expert opinion) versus *quantitative* (objective tools) analysis supporting the study, as well as, the comprehensiveness or the study. Section 2 of this guidance discusses each step in the FSA process, and as an aid, suggests "Best Practices" for accomplishing some of the steps of the process. These "Best Practice" sections also include discussion of the LoE elements for the methodology proposed.

Section 1—FAA/FNA/FSA Process Overview

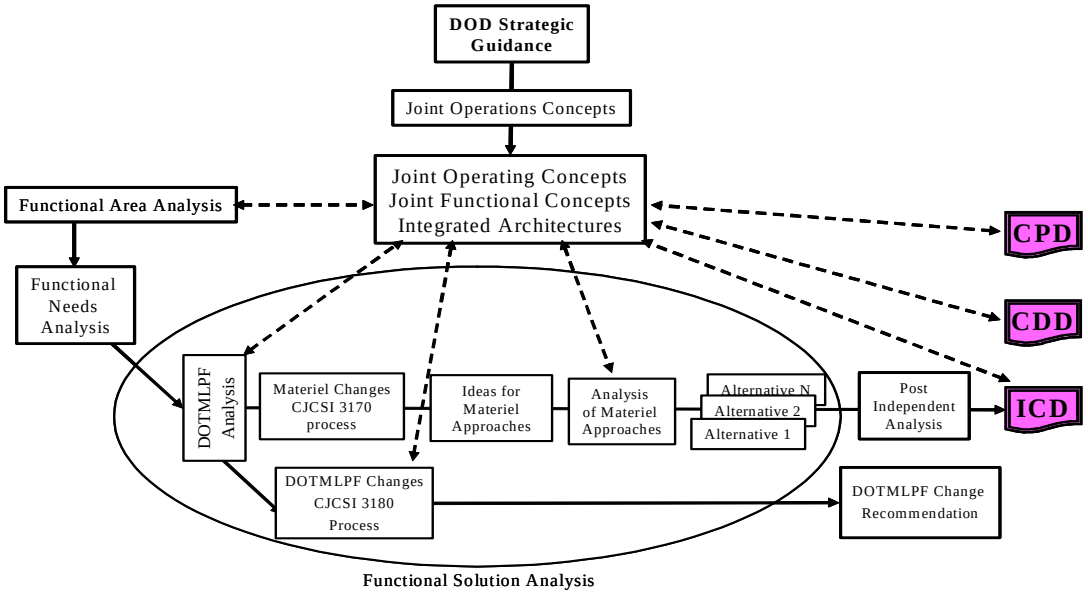
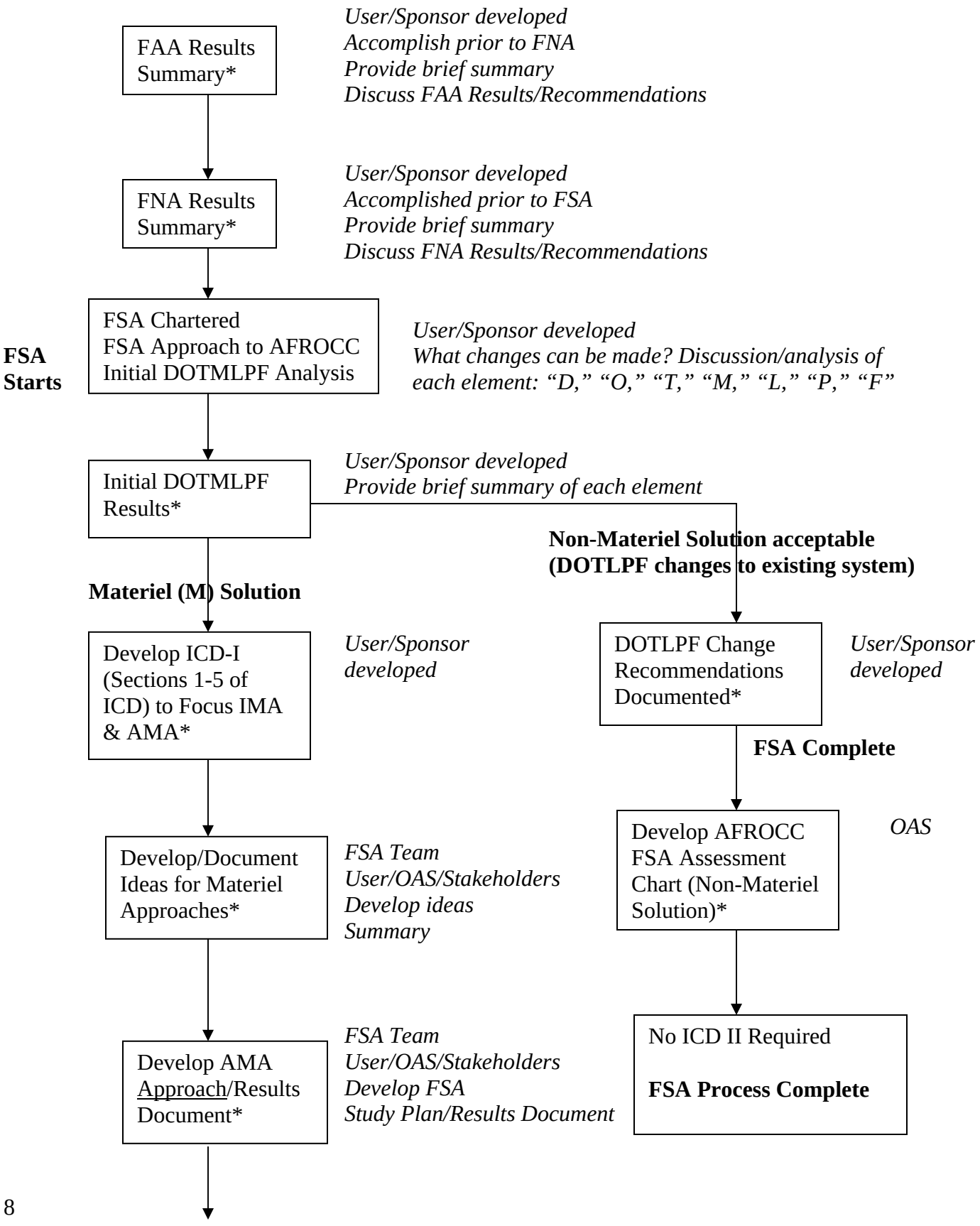


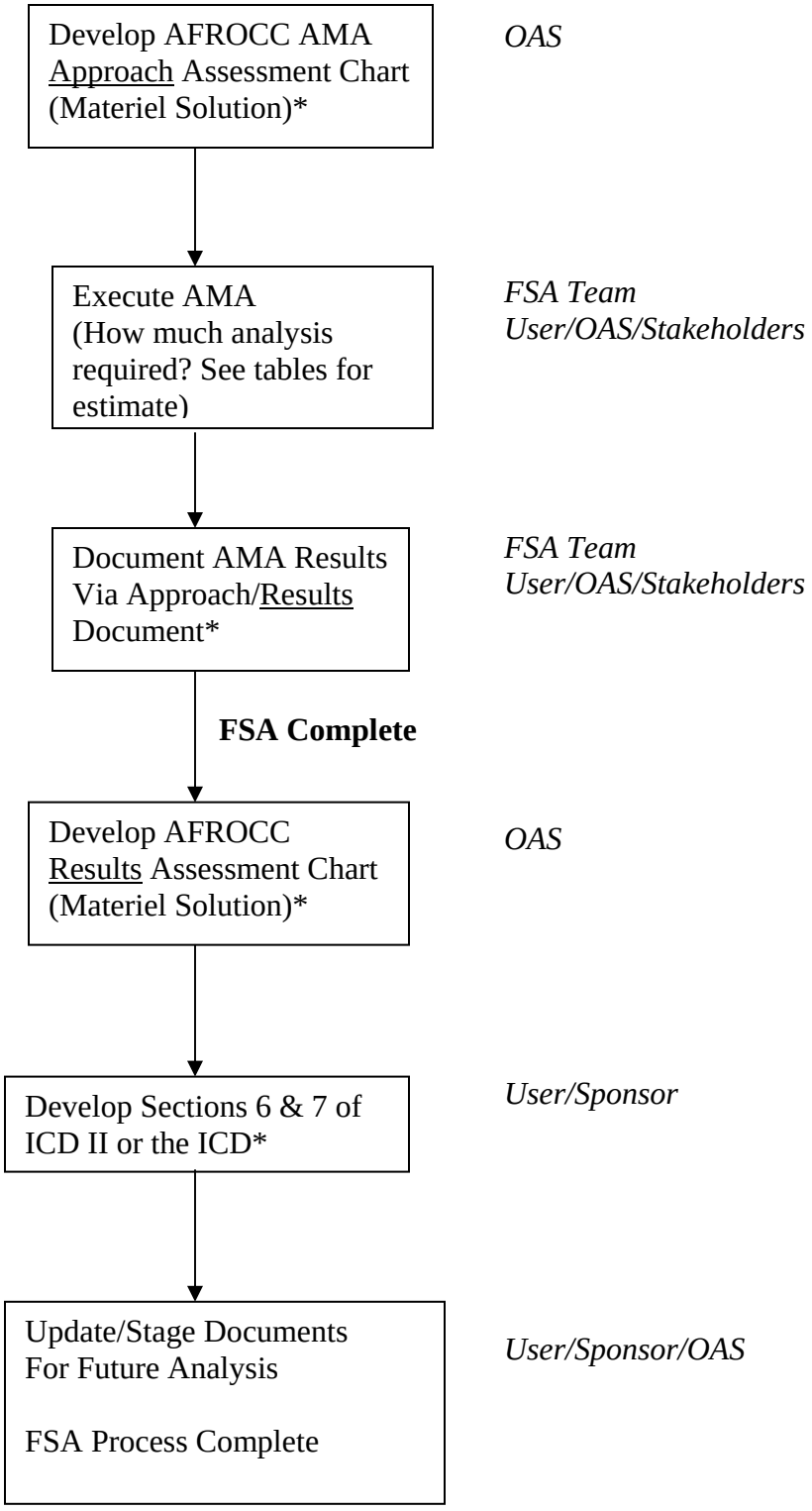
Figure 1-1: JCIDS Analysis

1. JCIDS Analyses. The JCIDS analysis process is composed of a structured, four-step (FAA, FNA, FSA & Post Independent Analysis [PIA]) methodology that defines capability gaps, capability needs and approaches to provide those capabilities within a specified functional or operational area. Based on national defense policy and centered on a common joint warfighting construct, the analyses initiate the development of integrated, joint capabilities from a common understanding of existing joint force operations and doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF) capabilities and deficiencies. While a JCIDS analysis may be initiated by any number of organizations, to include combatant commanders and Functional Capabilities Board (FCB) Working Groups, this analysis needs to be teamed as early as possible with a user/sponsor. The term "user/sponsor" as applied in this document is used to describe this collaborative effort between the analytical author of the analysis and the organization/user that will eventually lead the funding of any resulting materiel solutions. The assistance and advice of appropriate FCB Working Groups should be sought out as early as possible during analysis to facilitate the collaborative effort across many organizations. The sponsor initiated JCIDS analyses provide the necessary information for the development of the ICD. Figure 1-1 above depicts the JCIDS analysis process.

Figure 1-2 depicts a step-by-step flow of those FAA/FNA/FSA elements that must be accomplished during the JCIDS analyses process. This section also defines the details in conducting the pre-FSA analyses (FAA and FNA). Section 2 contains a step-by-step discussion of the FSA elements.

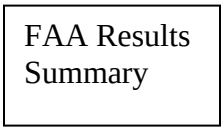
Figure 1-2: FAA/FNA/FSA Flow Diagram





*** Develop Document – Documentation Required**

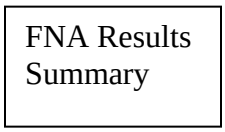
2. The following paragraphs discuss in detail the **pre-FSA JCIDS** steps outlined in the diagram. **Section 2** provides details related to the **FSA and post-FSA JCIDS** steps outlined.



Functional Area Analysis (FAA). The first step in the JCIDS analysis begins when the user/sponsor leads execution of an FAA. An FAA identifies the operational tasks, conditions and standards needed to achieve military objectives. It uses the national strategies, Joint Operating Concepts (JOC), Joint Functional Concepts (JFC), Joint Integrating Concepts (JIC), Integrated Architectures (as available), the Universal Joint Task List (UJTL) and the anticipated range of broad capabilities that adversaries might employ as input. Its output is the tasks to be reviewed in the follow-on FNA. The FAA includes cross-capability and cross-system analysis in identifying operational tasks, conditions and standards. The FAA should be conducted as a collaborative effort, involving support agencies and stakeholders in addition to the user/sponsor agency. The FAA should accomplish the following:

a. Identified tasks should be submitted to Defense Intelligence Agency (DIA) to enable production of an Initial Threat Warning Assessment (ITWA). The ITWA will identify adversarial capabilities that could specifically affect a capability being identified. Contact the DIA Defense Warning Office, Acquisition Support Division at DSN 428-4526 for any required assistance.

b. The documented FAA Results Summary should address the capability shortfalls, operational tasks, conditions and standards needed to meet military objectives that were identified during the execution of the FAA. Cross-capabilities and cross-systems from other MAJCOMs, Other Services and allies should be examined in these terms.



Functional Needs Analysis (FNA). The FNA is the second step of the JCIDS analysis process. The user/sponsor leads the FNA. It assesses the ability of the current and programmed joint capabilities to accomplish the tasks that the FAA identified under the full range of operating conditions and to the designated standards. Using the tasks identified in the FAA as primary input, the FNA produces as output a list of capability gaps or shortcomings that require solutions and indicates the time frame in which those solutions are needed. The FNA should accomplish the following:

a. Describe the capability gap(s), overlap(s) or problem(s) in operational and/or broad effects-based terms. It should include consideration of gaps or problems identified in

combatant commander issues and Integrated Priority Lists (IPLs). Future adversarial threat capabilities and scientific and technological developments as depicted in the ITWA will be considered.

b. Describe what additional functional areas may be involved in the problem or solution.

c. Describe the key attributes of a capability or capabilities that would resolve the issue in terms of purpose, tasks and conditions. This description should address the elements of time, distance, effects and obstacles to overcome. Link the discussion to the UJTL, adjusting for situations not covered within the UJTL. These descriptions will enable the development of measures of effectiveness (MOEs) in the AMA and AoA.

d. Identify the Joint Requirements Oversight Council (JROC) approved functional area metrics, as derived from the integrated architectures (as available), which the proposed capability improves or upgrades. If integrated architectures do not yet exist for this functional area, propose the appropriate metrics.

e. The documented FNA Results Summary should address the ability of the current and programmed joint capabilities to accomplish the tasks that were identified during the FNA.

Section 2—FSA and post-FSA Process Discussion

Functional Solution Analysis (FSA). The FSA which is the third step of the JCIDS analysis process. The user/sponsor leads the FSA. It is an operationally based assessment of potential DOTMLPF approaches to solving (or mitigating) one or more of the capability gaps (needs) identified in the FNA. The needs identified in the FNA are inputs to the FSA. The FSA's outputs are potential solutions to needs, including in order of priority: integrated DOTLPF changes; product improvements to existing materiel or facilities alone; adoption of interagency or foreign materiel solutions that have limited non-materiel DOTLPF consequences; and finally, new materiel starts that have limited non-materiel DOTLPF consequences.

The FSA integrates these solutions, develops options of "mixes of solutions" within each MAJCOM and across the Air Force and develops an unconstrained capabilities plan for each functional area and functional support area. FSAs are operationally based assessments of potential DOTMLPF approaches to solving (or mitigating) one or more of the capability gaps (needs) identified in the FNA. FSA solution sets developed by the MAJCOMs may be used during the Integrated-CRRA (I-CRRA) in developing recommendations. Outputs of the FSA process are more detailed, subordinate levels of capability development roadmaps that describe the relationships between systems and programs and how they combine to produce overall capabilities. The lowest level of a FSA roadmap is the system itself, and those attributes the system requires to perform the tasks necessary to contribute to the overall capability.

FSA Chartered Initial DOTMLPF Analysis

a. DOTMLPF Analysis Step 1 (non-materiel approach to improve existing system capabilities). Note: A discussion of the "M" (materiel analysis) follows in paragraph b. The first level of analysis in the FSA is to determine whether a non-materiel (DOTLPF) approach can fill the capability gaps in the existing system identified in the FNA. Non-materiel approaches include changes in the DOTLPF elements affecting the current system (status-quo). If the user/sponsor determines that the capability can be partially or completely addressed by the DOTLPF changes in the existing system, the user/sponsor will coordinate with the appropriate Department of Defense (DoD) component to take action through the process outlined in Chairman, Joint Chiefs of Staff Instruction (CJCSI) 3180.01, "*Joint Requirements Oversight Council (JROC) Programmatic Processes for Joint Experimentation and Joint Resource Change Recommendations*." Following are recommended DOTLPF analysis steps:

Doctrine—Review and assess current doctrine with key stakeholders. Will updates and/or changes to current doctrine help resolve issues identified? If yes, identify and document updates/changes required.

Organization—Review and assess current organizational structure with key stakeholders. Will organizational restructure and/or changes help resolve issues identified? If yes, identify and document updates/changes required.

Training—Review and assess current training process with key stakeholders. Will updates and/or changes to training process help resolve issues identified? If yes, identify and document updates/changes required.

Leadership—Review and assess current leadership with key stakeholders. Will updates/changes to the leadership process to help resolve issues identified? If yes, identify and document updates/changes required.

Personnel—Review and assess current personnel manning situation with key stakeholders. Updates and/or changes to personnel manning help resolve issues identified? If yes, identify and document updates/changes required.

Facilities—Review and assess the current facilities situation with key stakeholders. Updates and/or changes to existing facilities help resolve issues identified? If yes, identify and document updates/changes required.

The first step looking at the non-materiel solution is to define, and obtain agreement on what is meant by "status-quo" (i.e. the existing system). This can be a difficult endeavor in some instances, due to the number of configurations of the existing system, near-term changes to the existing system that may already be underway, or are already funded and scheduled. However, it is important to have this understanding and agreement, as it affects the credibility and outcome of the DOTLPF analysis, and may affect the scope of the FSA, and follow-on AoA if required.

A "Best Practice" Suggestion. Assume a typical current or future mission for the existing system, and list the tasks required to accomplish the mission. Next, list the process steps for each task, then for each step in each task, determine whether or not a change to any combination of the DOTLPF elements would make that step or task more effective, more efficient or require less support. Repeat this process for several typical current or future missions, this will enable the FSA Special Task Force (FSA Team) to determine which DOTLPF elements can be changed to improve overall effectiveness of the existing system, and in what way the elements would have to be changed. If ***each*** mission requires a completely different type of change to the DOTLPF elements to improve capability of the existing system to achieve the mission, then determine whether or not the changes required for one mission conflict with those of the other missions. If this is the case then the non-materiel solution is not viable for providing the required capability.

If the pair-wise comparisons result in a compatible set of DOTLPF changes, next determine whether or not there are remaining shortfalls in the required capability, and the severity of the shortfalls in accomplishing all of the missions. If there are severe shortfalls, then the non-materiel solution is not viable.

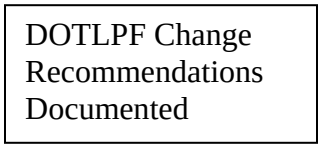
If there are no shortfalls, or they are acceptable, determine whether or not the required DOTLPF changes are feasible. In this case determine whether or not the changes required to doctrine, for example, would violate existing treaties, foreign agreements, national policy, social policy, etc. If feasible, next determine rough-order-magnitude costs and affordability of making the required DOTLPF changes. If the changes are not feasible or affordable, then the non-materiel solution is not viable.

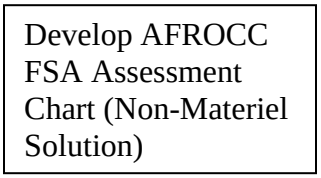
Note that for this initial analysis, subject-matter-expert (SME) opinion is appropriate. In order to increase the credibility of the analysis the FSA team should endeavor to include a diverse group of SMEs in the process, from all user/sponsor, stakeholder and support organizations, and to examine the DOTLPF characteristics under the conditions of a wide variety of "mission" cases. It is also advisable to include doctrine experts, personnelists, and trainers as members of the SME team.

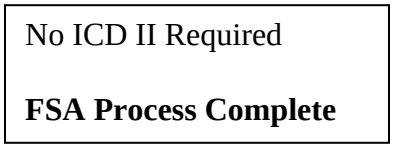
LoE Considerations – The credibility of this type of this "best practice" is increased by including a more diverse mix of SMEs in the process and by examining a wider variety of missions in the study. Comprehensiveness of this practice is increased by examining a larger number of missions and environments for performing those missions. Rigorousness, and possibly objectivity of the analysis can be increased by using stochastic digital simulations or value-based models. The time required to accomplish this task increases with the addition of SMEs and/or scenarios, and/or with the use of models/simulations; therefore, the study team must balance their time constraints with the degree of credibility desired/required for this step of the analysis.

Based on this analysis, if the DOTLPF changes to the status-quo alone provide acceptable capability, are feasible and affordable, then the non-materiel solution should be the preferred solution. However, if the user/sponsor determines that non-materiel (DOTLPF) changes alone are inadequate and a materiel approach is required, proceed to paragraph b.

The results of the DOTMLPF analysis for both non-materiel and/or materiel solutions are documented by the user/sponsor to support current and/or future analyses.







Non-Materiel Solution(s). If the DOTMLPF analysis demonstrates a potential non-materiel solution, only the DOTLPF change recommendations will be documented in the

FSA Results document. This is followed by the development of the AFROCC Assessment Chart by OAS. No ICD II is required.

Develop ICD-I (Sections 1-5 of ICD) to Focus IMA & AMA

In the event that the non-materiel solution is ***not*** viable, the results of the "SME" analysis conducted in step 1, above should be used to help refine the understanding and documentation of the shortfalls of the Status Quo. At this point, the FSA team should help with the initial development of the Initial Capabilities Document (ICD).

Interested readers can seek guidance for ICD development in AFI 10-601 and CJCSM 3170.01. The FSA team should be aware of the ICD development because it can help focus their knowledge and may help determine initial materiel alternatives. This work can also help the team to determine good mission tasks (MTs) and measures of effectiveness (MoEs) for the FSA Study Plan. Members of the ICD HPT might also be a good source of team members for the FSA.

The AF/XORD should be contacted for potential ACAT I and II programs. They have set up a process to help develop the ICD. The process begins with ICD stage I development, and includes sections 1-5 of the document. Regardless of the potential acquisition category, developing the first five sections of the ICD will help the FSA team focus their knowledge, so that initial materiel alternatives can be determined. This work will also help the team determine good mission tasks (MTs) and measures of effectiveness (MOEs), for the next phases of study.

Regardless of the potential ACAT of the solution, the AF/XORD process is a good methodology to use. Their website (https://www.afreqs.hq.af.mil/) provides information and templates for this process. Additionally, the AF/XORD staff can answer questions and provide sources of information, although they may not be able to provide personnel to support the potential ACAT II or III efforts.

A "Best Practice" Suggestion – The High Performance Team (HPT). AF/XORD recommends developing the ICD (stage I or stage II) by hosting an HPT. This is a 1 to 2 week meeting of SMEs, users, stakeholders and XORD personnel who meet to rapidly develop the ICD. Usually, a small group of personnel at the lead agency prepares a "strawman" ICD, which is sent out to the larger HPT group as a read-ahead. The HPT group then meets to refine and revise the strawman, and to determine what agencies should coordinate on it, and to develop a coordination schedule.

The advantage of the HPT concept is that it accomplishes a lot of work in a relatively short amount of time. The goal is for the lead agency to develop the strawman based on

"best" inputs from their agency, then invite HPT members from other agencies that will be affected by the potential capability solution. This should include stakeholder and support agencies, as well as agencies that may be supporting, maintaining, or providing training for use of the new capability solution. The advantage is these diverse participants will provide a more comprehensive discussion of all aspects of the possible capability solution. It also involves these agencies in the process of describing/studying the capability, which increases their understanding of the process, and acceptance of the follow-on analysis. Additionally, the HPT members are expected to return to their agencies and act as liaison between their agencies population and the lead agency. These folks can "grease the skids" for the coordination process, and AF/XORD's intent is for this process to help streamline the coordination process, usually within 30 days following the HPT. Participation of the AF/XORD staff members helps to ensure that the AFROCC perspective is included in the HPT work. The AF/XORD staff can also help to expedite the coordination process.

The HPT participants may also become members of the FSA study team, or will be able to help the lead agency identify possible participants from their agencies or disciplines.

Develop/Document Ideas for Materiel Approaches

b. DOTMLPF Analysis Step 2 (Materiel Solution(s)). If step 1 of the DOTMLPF analysis demonstrates a need for potential materiel (M) solution(s), the next step is to develop and document ideas for materiel approaches, using the following guidelines.

Ideas for Materiel Approaches. The expertise of the entire AF and other appropriate sources should be engaged to identify materiel approaches to provide the required capabilities. The collaborative nature of this effort is meant to develop potential solutions in an integrated fashion that reflect the future requirements of joint force commanders. The process should leverage the expertise of all government agencies, as well as industry, in identifying possible materiel approaches. It should always include existing and future materiel programs that can be modified to meet the capability need. The integrated DOTMLPF implications of any proposed materiel (M) solution must also be considered throughout the process.

The FSA team should keep in mind that at this point, the goal is not to engineer a system. The goal is to determine the best direction for providing the required capability. The team should list types or categories of alternatives (e.g. satellite, armed airframe, ground launched weapon, malicious computer code) vice systems (e.g. B-2, with weapons modifications).

List and describe briefly all ideas generated for materiel approaches. These ideas will be used in the next step of the FSA, the Analysis of Materiel Approaches (AMA).

Develop AMA Approach Document	Develop AFROCC Approach Assessment Chart (Materiel Solution)	Execute AMA Process (How much analysis required? See tables for estimate)

c. Analysis of Materiel Approaches (AMA). The intent of the AMA is to determine the best materiel ***approach*** or combination of approaches to provide the desired capability or set of capabilities to meet identified gaps/needs. The process is initiated by developing the FSA Study Plan. Section 3 contains an outline of the elements that should be contained in the FSA Study Plan. After the FSA Study Plan is developed, but prior to FSA execution, the FSA Study Plan will be presented to the AFROCC (applies to all potential ACAT I programs and others as requested by the AFROCC). OAS will review the FSA Study Plan and provide the AFROCC with an assessment of the plan. The AFROCC will then approve/disapprove the proposed FSA Study Plan. If the FSA Study Plan is disapproved, the AFROCC will provide additional direction. Upon AFROCC approval, the FSA will be performed to determine the best way(s) to use a materiel approach(es) to provide a capability (joint and/or service unique as applicable). Generally, it will not consider which specific "systems" or "system components" are the best. For example, the AMA may determine that a capability is best satisfied by an unmanned aerial vehicle (UAV) with a bomb vice approaches employing submarine launched missiles, artillery or air launched missiles. The AMA will not assess the best alternatives for UAVs or bombs. That analysis will occur in an AoA executed after the ICD is approved. Specifically:

(1) The user/sponsor will collate the information obtained during the FAA, the FNA, the DOTMLPF analysis (FSA) and the ideas for materiel approaches. At this point, a number of approaches may be available to provide the desired capabilities. In this case, the user/sponsor, with support from the Joint Staff, J-8, Capabilities and Acquisition Division (CAD) and the appropriate FCB Working Groups, will determine whether to submit the information to an appropriate research agency (such as a Federally Funded Research and Development Center (FFRDC) for independent analysis or to conduct the AMA itself. An independent analysis may be required to provide an objective review that serves the capability needs of the joint force.

(2) The AMA will consider the capability gap(s), the specified range of military operations, the conditions under which they must be performed and other factors that are relevant to supporting JFCs and integrated architectures.

(3) The AMA will determine how well the proposed materiel approaches address the identified capability gaps and provide the desired effects. The materiel approaches may include a family of systems (FoS) or system of systems (SoS) that take different approaches to filling the capability gap(s), each addressing operational considerations and compromises in a different way. The approaches shall include the overarching DOTMLPF elements necessary to meld the FoS and SoS into an effective capability.

The FoS and SoS materiel approaches may require systems delivered by multiple users/sponsors and materiel developers.

Document AMA Results Via Approach/Results Document

(4) The product of the AMA is a prioritized list developed by the user/sponsor of materiel approaches (or combinations of approaches) ranked by how well each provides the desired capabilities. The prioritized list will consider technological maturity, technological risk, supportability and the affordability of each approach using the best data available in the pre-ICD process. The AMA will also assess the operational risk associated with each approach. It will also consider the integrated DOTMLPF implications of each approach, to the extent that those implications can be identified. Finally, it will consider the overall impact of the recommended materiel approach on the functional and cross-functional areas. The results of the AMA will be documented by the user/sponsor in the FSA Results Document. The AMA must:

(a) Confirm the nature of the capability or broad-based effect(s) to be provided, when the capability is required, and the applicable operational environment. This capability confirmation must include a rough assessment of the sustainability/supportability of the end item system or SoS.

(b) Examine the ability of the identified ideas for materiel approaches to provide the desired capability or capabilities under the conditions specified.

(c) Evaluate the delivery time frame for each approach.

1. For approaches using existing capabilities or capabilities already scheduled for delivery, examine how the delivery of the proposed capability ties in to the existing program.

2. For new materiel approaches, evaluate when a useful capability could be delivered to the warfighter through the use of existing technology.

3. For approaches based on FoS and SoS solutions, evaluate the necessity to synchronize the development of systems and integrated DOTMLPF considerations across users/sponsors and materiel developers.

4. Evaluate when a new or increased capability could be delivered by bringing together existing or new systems in new ways.

(d) Identify technologies, if matured, would provide a more effective approach in the future.

(e) Examine additional approaches, as required. Conduct market research to determine if commercial items or non-developmental items are available to meet the desired capability, or could be modified to meet the desired capability. If market research indicates commercial or non-developmental items are not available to satisfy the need, re-evaluate the need and determine whether it can be restated to permit commercial or non-developmental items to satisfy the required capability.

(f) For each materiel solution, the DOTLPF characteristics that affect development and operation must be defined and significant DOTLPF issues addressed as a part of the AMA.

"Best Practice" Suggestions

- Defining "representative," notional solutions under each approach or type of solution can help the study team better understand the approach/type, and make the comparison of the individual approaches easier. The study team should keep in mind that they will not be recommending the pursuit of the representative defined for an approach, but the approach itself.

    - The study team should survey industry practices, technologies and products currently available, or will be in the near future. This can be accomplished via web searches and/or a RFI(s) to industry. The principles and constructs can then be incorporated into representative approach definitions.
    - The study team should also research ongoing or projected technology development by surveying laboratories and research agencies.
    - Finally research what other government, non-government and foreign countries may be doing that could provide elements to provide the capabilities the team is seeking.

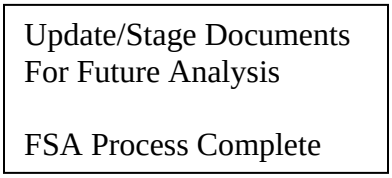
  The study team should combine elements and principles from all of these sources and others, as appropriate to create the notional representative definition for each approach. The definition should include proposed CONOPs/CONEMPs, which should include sustainability approach and training considerations. It should also address the DOTLPF characteristics for operating or acquiring the type of solution. This exercise helps the team focus on these elements for each approach, providing a better understanding of all aspects of taking one approach over another.

  Once the study team has defined the representatives in each approach category, it is a good idea to get a sanity check on these definitions from the larger user community and stakeholder and support agencies. One way to do this fairly quickly is to convene an HPT, where the diverse, non-study team members come in for 3-5 days, to review the work of the study team, discuss it and together with the study team refine the representative definitions. Another way is to send out the products for review and comment. In this instance, the study team is not seeking a formal coordination, but rather, the sanity check that they have captured all of the important aspects of each approach for providing the capability. Reviewers should include "select" representatives from the larger user community, support community and stakeholder agencies.

- A good way to conserve time and resources is to conduct the analysis (e.g. alternative comparisons) in phases. The goal of each phase should be to eliminate approaches from further consideration, and to focus analysis for the next phase. Each phase should be a more in-depth and rigorous investigation of the remaining approaches.

    - Include at least two analysis phases
    - In each phase assess first the effectiveness of the representative of the approach category and then the costs (e.g. if an approach doesn't provide the required capability, eliminate it from further consideration. If it does provide the capability, are the costs such that the government can afford it?).
    - In the early phases of the analysis, the "cost analysis" should concentrate on identifying potential cost drivers and risks, and the severity of those risks, and relative (e.g. compared to the other approaches) and then ball park estimates.
    - In subsequent phases, the cost estimates will evolve through more rigorous scrutiny and estimating methodologies to ROMs, and finally to range estimates.
    - At each phase, identify areas for the next phase of the analysis
    - The effectiveness analysis should be focused on the mission tasks identified in the ICD.
    - The effectiveness analysis should demonstrate "military worth" of the approach
    - After each analysis phase get a sanity check from the larger community on the results of the analysis and focus of the next phase of analysis, via HPT or email review.

Upon completion of the FSA effort, OAS will provide an assessment of the FSA results to the AFROCC. The AFROCC will concur/non-concur and provide further direction. Upon concurrence, the user/sponsor will precede with development of sections 6 and 7 of the ICD II or the ICD.



Post Independent Analysis (PIA). The final step in the JCIDS analysis process is the PIA. In this step, the user/sponsor will consider the compiled information and analysis results to determine which integrated DOTMLPF approach or approaches best address the joint capability gap(s) in the functional area. This information will be compiled into an appropriate recommendation—either a DOTLPF change recommendation, or an ICD describing the capability requirements for a materiel solution. The user/sponsor, key stakeholders and OAS

should update, save and stage all documents for potential future analyses. The study sponsor's organization should submit the FSA Final Report to DTIC. The JCIDS process is now complete.

A "Best Practice" Suggestion. Following the final analysis phase, host an HPT for representatives of the larger community.

- Review the analysis results
- Determine the implied recommendations of the results
- Determine "best" methods for clearly printing the results and recommendations to leadership and decision makers.

The OAS is available to support FSA study teams by providing the following:

- Team training
- Interpretation of guidance
- Recommendations for study methodology
- Support for developing the Study Plan
- Sources of information
- Independent review of documents, results and study team products

Section 3—FSA Study Plan Outline

The FSA "Study Planning" document provides sufficient detail necessary for planning and documenting an operationally based assessment of all potential DOTMLPF approaches to solving (or mitigating) one or more of the capability gaps (needs) previously identified. The initiative's sponsoring MAJCOM/Agency is responsible for drafting and presenting the FSA Study Plan along with the ICD Stage I to the AFROCC. The FSA Study Plan serves two purposes: (1) it provides an initial plan for the FSA effort and (2) it provides a document, similar to the plan, to record the results of the FSA. The following outline represents key items that should be addressed in any FSA effort; however, this format is a suggestion, the FSA team should tailor their study plan to meet the needs of their particular analysis.

Introduction
- Background (Describe Briefly)
- Purpose (Describe Briefly)
- Scope (Describe Briefly)
- FAA Results (Describe/List Briefly)
- FNA Results (Describe/List Briefly
- DOTMLPF Results (Describe/List Briefly)

Acquisition Issues
- Mission Need (Describe Briefly)
- Scenarios (Describe Stressing Scenarios Briefly—No Need For Approved Scenarios)
- Threats (List Known Potential Threats—Be Brief)
- Environment (List Most Likely—Be Brief)
- Constraints/Assumptions (List/Describe—Be Brief)

Material Approaches/Alternatives
- Descriptions (Describe)
- Operations Concepts (Describe Briefly If Known)

Determination of Effectiveness Measures
- MTs (List Potential/Known)
- MOEs (List Potential/Known)
- MOPs (List Potential/Known)

Effectiveness Analysis
- Methodology (Describe "Soft" Analysis Approach)
- Models, Simulations and Data (If Known—Identify Potential M&S and Data Availability)
- Risk Issues (Briefly List/Describe Known Effectiveness Risk Issues)

Cost Analysis
- Methodology (Describe "Soft" Assessments/Analogies That Will Provide Cost Rough Order Of Magnitude (ROM) Figures)
- Models and Data (If Known—Identify Potential Models and Data Availability)
- Risk Issues (Briefly List/Describe Known Cost Risk Issues)

Cost-Effectiveness Comparisons

- Methodology (Briefly Describe/Show Ranking Process)
- Criteria for Screening (Briefly Describe How Non-Viable Approaches Will Be Identified)

Organization & Management

- FSA Team Organization (List FSA Players, Organizations and Telephone Numbers)
- Review Process (List Internal Agencies/Organizations)
- Schedule (Develop/List Proposed Schedule)

Section 4—FSA Results Document Outline

The FSA "Study Results" document provides sufficient detail necessary for documenting an operationally based assessment of all potential DOTMLPF approaches to solving (or mitigating) one or more of the capability gaps (needs) previously identified. The initiative's sponsoring MAJCOM/Agency is responsible for drafting and presenting the FSA Results document along with the ICD Stage II to the AFROCC. The FSA Results document serves two purposes: (1) it is structured towards the needs of the decision makers, and includes a brief description of the FSA process, while focusing on the results of the study (2) it provides a document that records results of the FSA. Currently there is no template available for the FSA Results. However, the following format represents key items that should be addressed in any FSA effort:

Introduction
- Background (Describe Briefly)
- Purpose (Describe Briefly)
- Scope (Describe Briefly)
- FAA Results (Describe/List Briefly)
- FNA Results (Describe/List Briefly
- DOTMLPF Results (Describe/List Briefly)

Acquisition Issues
- Mission Need (Describe Briefly)
- Scenarios (Describe Stressing Scenarios Briefly—No Need For Approved Scenarios)
- Threats (List Known Potential Threats—Be Brief)
- Environment (List Most Likely—Be Brief)
- Constraints/Assumptions (List/Describe—Be Brief)

Materiel Approaches/Alternatives
- Descriptions (Describe)
- Operations Concepts (Describe Briefly If Known)

Determination of Effectiveness Measures
- MTs (List Potential/Known)
- MOEs (List Potential/Known)
- MOPs (List Potential/Known)

Effectiveness Analysis
- Methodology (Describe "Soft" Analysis Approach)
- Models, Simulations and Data (If Known—Identify Potential M&S and Data Availability)
- Risk Issues (Briefly List/Describe Known Effectiveness Risk Issues)

Cost Analysis

- Methodology (Describe "Soft" Assessments/Analogies That Will Provide Cost Rough Order Of Magnitude (ROM) Figures)
- Models and Data (If Known—Identify Potential Models and Data Availability)
- Risk Issues (Briefly List/Describe Known Cost Risk Issues)

Cost-Effectiveness Comparisons

- Methodology (Briefly Describe/Show Ranking Process)
- Criteria For Screening (Briefly Describe How Non-Viable Approaches Will Be Identified)

Organization & Management

- FSA Team Organization (List FSA Players, Organizations and Telephone Numbers)
- Review Process (List Internal Agencies/Organizations)
- Schedule (Develop/List Proposed Schedule)

Results

- Effectiveness of Approaches/Alternatives
- Cost of Approaches/Alternatives
- Cost/Effectiveness Comparisons Listings
- Lessons Learned (Document For Future Analyses)
- Best Practices (Document For Future Analyses)

A "Best Practice" Suggestion. Capture results and information as the FSA progresses. The FSA is a research process; therefore, the FSA team's knowledge will evolve over time. This causes the understanding of the capability requirements, the definitions of the approaches and methodologies for studying them to change. Therefore, it is critical to capture these changes in near real time, as it will be impossible to recall the changes made, lessons learned, and knowledge obtained at the end of the entire FSA process. There are two ways to capture this evolution: (1) The FSA team can periodically revise the FSA Study Plan, and at the end of the FSA, dump the information into the FSA Report, along with the FSA results. (2) The FSA team can periodically (or incrementally) update the FSA Report. In either case, it is wise to share the progress of the FSA with the larger community. This promotes understanding and acceptance of the FSA results. It also provides the FSA team with relevant feedback from the larger community. The FSA team should only go to the AFROCC if there is a significant change in the scope of the FSA, or in the methodology proposed for accomplishing the study, and at the end of the FSA, with the results.

The advantage of option 2 for capturing evolution of the FSA, is that the incremental report can be sent to the larger community (e.g. users, stakeholders, etc,) as information. Additionally, publishing an incremental report vice continually updating the Study Plan, promotes the idea that the FSA team is making progress, vice continually "planning".

The additional understanding of the capability requirements should also be integrated into the ICD stage II periodically throughout the FSA process, and the FSA team should organize itself or interface with the group designated to develop this document.

Section 5—AFROCC FSA Study Plan Assessment Chart

(*Study Planning*)	
FAA accomplished	yes (when)/no
FNA accomplished	yes (when)/no
FSA DOTMLPF accomplished	yes (when)/no
Materiel solution needed	yes/no
FSA mission tasks and measures based on MNS/ICD	R/Y/G
All relevant issues and constraints addressed	R/Y/G
Range of approaches/alternatives is comprehensive	R/Y/G
Operational concepts are reasonable/probable	R/Y/G
Threats and scenarios are realistic/probable	R/Y/G
FSA measures will support ICD Development	R/Y/G
Effectiveness analysis approach is acceptable for FSA	R/Y/G
Cost analysis approach is acceptable for FSA	R/Y/G
Model availability and applicability for cost and effectiveness analyses	R/Y/G
Cost-effectiveness methodology approach is sound	R/Y/G
Overall risk and schedule is reasonable	R/Y/G

Section 6—AFROCC FSA Results Assessment Chart

(*Study Results*)	
FAA accomplished	yes (when)/no
FNA accomplished	yes (when)/no
FSA DOTMLPF accomplished	yes (when)/no
Materiel solution needed	yes/no
FSA Plan validated by the AFROCC	yes/no
DOTLPF characteristics appropriately defined for each alternative	R/Y/G
FSA Plan followed with minor (and appropriate) variations	R/Y/G
Overall risk and schedule is reasonable	R/Y/G
Results acceptable	R/Y/G
Additional analysis (AoA) recommended	yes/no
Lessons Learned documented	yes/no
Best practices documented	yes/no

Appendix A: Capability Development Checklists and LoE Guidelines

Table Explanation
The title bar lists the service or agency for which the capability has potential. The second row "Capability Type" indicates the type of potential capability and its potential application to a particular enterprise or agency. The first column "Process/Decision" lists the process or type of analysis, or potential decision authority. The letters in the table cells indicate whether or not the process, analysis is required, or the most likely decision authority.

Cell Letter Key
Y= yes; N= no; H= yes, with high LoE (e.g. rigorousness/comprehensiveness of analysis required); M= medium, with medium LoE (e.g. rigorousness/comprehensiveness of analysis required); L= yes with low LoE (e.g. rigorousness/comprehensiveness of analysis required).
CSAF=Chief Secretary of the Air Force; OSD=Office of Secretary of Defense

Capability **Type**	Table 1 - Potential AF Capability											
	Warfighter	Capability	(Non-IT)	Warfighter	Capability	(IT)	Business	Process	(Non-IT)	Business	Process	(IT)
Process/Doc	AF-Wide	MAJCOM	Unit	AF-Wide	MAJCOM	Unit	AF-Wide	MAJCOM	Unit	AF-Wide	MAJCOM	Unit
FAA	**H**	**H**	**L**	**H**	**H**	**L**	**M**	**M-L**	**L**	**H**	**H-M**	**L**
FNA	**H**	**H**	**L**	**H**	**H**	**L**	**M**	**M-L**	**L**	**H**	**H-M**	**L**
CRAA	**Y**	**Y**	**?**	**Y**	**Y**	**?**	**N**	**N**	**N**	**N**	**N**	**N**
ICD Stage 1												
FSA												
DOTLPF												
IMA												
AMA												
ICD Stage 2												
JCIDS												
AoA												
MS-A												
Guidance												
MDA	**CSAF**											

Capability Type	Table 2 – Potential Joint Capability (AF Led)											
	Warfighter	Capability	(Non-IT)	Warfighter	Capability	(IT)	Business	Process	(Non-IT)	Business	Process	(IT)
Process/Doc	Federal	DoD	Cross Service	Federal	DoD	Cross Service	Federal	DoD	Cross Service	Federal	DoD	Cross Service
FAA												
FNA												
CRAA												
ICD Stage 1												
FSA												
DOTLPF												
IMA												
AMA												
ICD Stage 2												
JCIDS												
AoA												
MS-A												
Guidance												
MDA												

Capability Type	Table 3 – Potential Joint Capability (non-AF Led)											
	Warfighter	Capability	(Non-IT)	Warfighter	Capability	(IT)	Business	Process	(Non-IT)	Business	Process	(IT)
Process/Doc	Federal	DoD	Cross Service	Federal	DoD	Cross Service	Federal	DoD	Cross Service	Federal	DoD	Cross Service
FAA												
FNA												
CRAA												
ICD Stage 1												
FSA												
DOTLPF												
IMA												
AMA												
ICD Stage 2												
JCIDS												
AoA												
MS-A												
Guidance												
MDA												

Capability Type	Table 4 – Potential Other Service/Agency (AF Interest or Stakeholder)											
	Warfighter	Capability	(Non-IT)	Warfighter	Capability	(IT)	Business	Process	(Non-IT)	Business	Process	(IT)
Process/Doc	Federal	DoD	Cross Service	Federal	DoD	Cross Service	Federal	DoD	Cross Service	Federal	DoD	Cross Service
FAA												
FNA												
CRAA												
ICD Stage 1												
FSA												
DOTLPF												
IMA												
AMA												
ICD Stage 2												
JCIDS												
AoA												
MS-A												
Guidance												
MDA												

Appendix B – Acronyms

ACAT	Acquisition Category
AFI	Air Force Instruction
AFROCC	Air Force Requirements for Operational Capabilities Council
AMA	Analysis of Materiel Approaches
AoA	Analysis of Alternatives
CAD	Capabilities Acquisition Division
CBP	Capabilities Based Planning
CDD	Capabilities Development Document
CJCSI	Chairman Joint Chief of Staff Instruction
COCOM	Combatant Command
CONEMP	Concept of Employment
CONOPS	Concepts of Operation
CPD	Capabilities Production Document
CRAA	Capabilities Review and risk Assessment
DIA	Defense Intelligence Agency
DoD	Department of Defense
DOTLPF	Doctrine, Organization, Training, Leadership & education, Personnel, Facilities
DOTMLPF	Doctrine, Organization, Training, **Materiel,** Leadership & education, Personnel, Facilities
FAA	Functional Area Analysis
FCB	Functional Capabilities Board
FFRDC	Federally Funded Research Development Center
FNA	Functional Needs Analysis
FoS	Family of Systems
FSA	Functional Solutions Analysis
HPT	High Performance Team
ICD	Initial Capabilities Document
I-CRAA	Integrating-Capabilities Review and Risk Assessment
IMA	Ideas for Materiel Approaches
IPL	Integrated Priority List
ITWA	Initial Threat Warning Assessment
JCB	Joint Capabilities Board
JCIDS	Joint Capabilities Integration and Development System
JFC	Joint Forces Concepts
JIC	Joint Integrating Concepts

JOC	Joint Operating Concepts
JROC	Joint Requirements Oversight Council
LoE	Level of Effort
MoE	Measure of Effectiveness
MT	Mission Task
OAS	Office of Aerospace Studies
PIA	Post Independent Analysis
RFI	Request for Information
ROM	Rough Order of Magnitude
SME	Subject Matter Expert
SoS	System of Systems
UAV	Unmanned Aerial Vehicle
UJTL	Universal Joint Task List
WG	Working group

Appendix C - References and Resources for Further Information

References

1. Department of Defense Directive (DoDD) 5000.1, *Defense Acquisition System,* USD(AT&L), 12 May 2003

2. Department of Defense Directive (DoDD) 5000.2, *Operation of the Defense Acquisition System,* USD(AT&L), 12 May 2003

3. Chairman Joint Chiefs of Staff Instruction (CJCSI) 3170.01D, *Joint Capabilities Integration and Development System,* J-8, 12 March 2004

4. Chairman Joint Chiefs of Staff Instruction (CJCSI) 3170.01A, *Operation of the Joint Capabilities Integration and Development System,* J-8, 12 March 2004

5. Chairman Joint Chiefs of Staff Instruction (CJCSI) 3170.01C, *Joint Capabilities Integration And Development System,* J-8, 24 June 2003

6. Air Force Instruction (AFI) 10-601, *Capabilities Based Requirements Development,* HQ USAF/XOR, 30 July 2004

7. Air Force Instruction (AFI) 10-604, *Effects Based, Capabilities Focused Planning* (DRAFT), HQ USAF/XOR, February 2004

Resources for Further Information

1. www.oas.kirtland.af.mil – Office of Aerospace Studies Home Page

2. http://www.afreqs.hq.af.mil/ - HQ USAF/XORD Home Page